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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/028,778	12/28/2001	Hiroaki Tanaka	8004-1013	4276

466 7590 03/18/2009
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EXAMINER	
ERDEM, FAZLI	

ART UNIT	PAPER NUMBER
2826	

MAIL DATE	DELIVERY MODE
03/18/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/028,778	TANAKA ET AL.	
	Examiner	Art Unit	
	FAZLI ERDEM	2826	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 December 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *54-60* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *54-60* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

Applicant's arguments filed 12/23/2008 have been fully considered but they are not persuasive. Applicant amended in dependent claim 54 to include "TiN film is exposed at each of said terminal" limitation. However, at various places Abe et al. and Fujikawa references disclose TiN film at exposed configuration. For instance, in column 11, lines 10-40, Abe et al. disclose TiN film at exposed configuration. Furthermore, in column 2 lines 50 to column 3 lines 11, Fujikara talks about exposing TiN film. Finally, in Fig. 1 of Shimada et al., terminal 9a/9b/9c on the right side is exposed to outside through contact layer 1. Likewise, terminal 4a/4b/4c on the left is also exposed.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. § 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

1. Claims 54-56, 58 and 60 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Abe et al. (6,661,476) in view of Shimada et al. (6,448,578) and Fujikawa (6,414,738).

Regarding Claim 54, Abe et al. disclose a liquid crystal display device in Fig 7, having an active matrix substrate having a transparent dielectric plate 1, thin film transistors (TFTs) arranged on the transparent dielectric plate 1, and pixel electrodes 2

arranged on the transparent dielectric plate 1; wherein the active matrix substrate includes scan lines G having a multilevel conductive structure 9/10 (thus meeting the "at least one of scan lines, signal lines, and common lines, each of the lines having a multilevel conductive structure" limitation).

The difference between the claimed device and Abe et al.'s device is that the claimed device requires the multilevel conductive structure to comprise a TiN film having a nitrogen concentration of 25 atomic % or higher, at a respective terminal thereof; the TiN film being located at a top of the multilevel conductive structure; and wherein a transparent conductive film is absent from the TiN film, whereas the scan lines of Abe et al.'s device comprise a multilevel conductive structure having a WSi film located at a top of the multilevel conductive structure.

However, Shimada et al. disclose a thin film transistor and liquid crystal display device where in Fig. 1 multilevel conductive structure scan lines 3c/3b/3a at a respective terminal (part 3a in Fig. 2) thereof comprises a TiN film 3c; the TiN film 3c being located at a top of the multilevel conductive structure 3c/3b/3a; wherein the TiN film 3c is completely covered by a 400 nm thick silicon nitride insulating film 11 (Fig. 1), so that a transparent conductive film is absent from the TiN film 3c. Furthermore, Fujikawa discloses a semiconductor display device where in Fig. 7 and in column 9, the required nitrogen concentration of higher than 25% is disclosed. In column 9, Fujikawa discloses that as the volume of nitrogen inside the mixing atmosphere increases, the content of nitrogen in TiN increases. Furthermore, also, in column 9, Fujikawa suggests that changing the nitrogen ratio to a different level would produce a different crystal

structure of TiN film. Along with Fig. 7, as column 9 suggests, one could arrive at the required 25% or higher nitrogen content/concentration in a TiN film. It is well understood in the art that in most known stable compounds of titanium nitride, the atomic percentage of nitrogen ranges from 37.5% to 55%. Note http://en.wikipedia.org/wiki/Titanium_nitride, where it is explained that according to published sources (for example L.E. Toth, Transition Metal Carbides and Nitrides (Academic, New York, 1971) stable compounds range in stoichiometry from $TiN_{0.6}$ to $TiN_{1.2}$, equivalent to nitrogen atom percentages of 37.5% to 55.4%. Note that the Examiner is not citing this Wikipedia article as an independent authority but simply in response to Applicant's assertion that the prior art fails to teach a "TiN film [which] itself has a nitrogen concentration of 25 atomic % or higher." It is true that neither Fujikawa or Shimada et al. state, in so many words, that the resultant nitrogen atom percentages of their films may range from 37.5% to 55.4%, but given the notorious nature of this fact they can hardly be faulted for failing to make a point of repeating it.

In the years that have past since the 1971 Toth reference cited in Wikipedia, many patent publications have described titanium nitride films with nitrogen concentrations higher than 25%. Among them are Snyder et al. 3,883,314 (TiN with 22.63 weight percentage, i.e. 49.5 atomic percentage, nitrogen); Snyder 4,591,418 ("[because] the color of TiN varies according the atomic percentage of nitrogen therein, the color of the titanium nitride can be adjusted to approximate the color of a selected gold or gold alloy by adjusting the flow of nitrogen during the deposition [as Fujikawa does].... most colors of commercial interest can be approximated by titanium nitride in which nitrogen

comprises 40 to 50 atomic percent"); Case et al. 5,008,217 (titanium nitride containing 45 to 55 atomic percent nitrogen); Sue et al. 5,071,693 (titanium nitride-containing compound having an atomic percent of nitrogen from 33% to 55%); and Sue et al. 5,185,211 (non-stoichiometric titanium nitride coating in which the atomic percent of nitrogen in the titanium nitride is between 32.5% and 47%). Claim 1 now includes limitation "TiN film is exposed at each of said terminal". However, at various places Abe et al. and Fujikawa references disclose TiN film at exposed configuration. For instance, in column 11, lines 10-40, Abe et al. disclose TiN film at exposed configuration. Furthermore, in column 2 lines 50 to column 3 lines 11, Fujikara talks about exposing TiN film. Finally, in Fig. 1 of Shimada et al., terminal 9a/9b/9c on the right side is exposed to outside through contact layer 1. Likewise, terminal 4a/4b/4c on the left is also exposed.

It would have been obvious to one of having ordinary skill in the art the time the invention was made to include the required multi-layer conductive structure and the required nitrogen concentration in Abe et al. as taught by Shimada et al. in and Fujikawa, respectively, order to have a liquid crystal display device with less film peeling and superior adhesion as disclosed in abstract section of Shimada et al.

Regarding Claim 55, the multilevel conductive structure of Shimada et al's Fig. 1 scan line 3a/3b/3c includes Al-based film 3b. Moreover, directly below this layer Shimada et al discloses titanium layer 3a.

Regarding Claim 56, Shimada et al.'s scan line 4 has the same multilevel conductive structure not only at the respective terminal 4a (figure 2), but also in the remaining parts thereof.

Regarding Claim 58, in Fig. 1, of Shimada et al., titanium nitride layer 4c is located at top, aluminum layer 4b is located in the middle, and titanium layer 4a is located at bottom.

Regarding Claim 60, in Fig. 1 of Shimada et al., middle layer 4b is aluminum.

2. Claim 57 is are rejected under 35 U.S.C. § 103(a) as being unpatentable over Abe et al. (6,661,476) in view of Shimada et al. (6,448,578) and Fujikawa (6,414,738), as applied to claim 54, and further in view of Nakamura (6,096,572).
Abe et al., Shimada et al., and Fujikawa suggest a liquid crystal display device having every limitation of claim 57 except the limitation that the multilevel conductive structure is a three-level structure formed by the TiN film located at the top, the Ti film located at the middle, and the Al-based film located at the bottom. The difference between the "invention" of claim 57 is that in claim 57 the Al-based film is on the bottom and the Ti film is in the middle, while in the liquid crystal display device suggested by Abe et al., Shimada et al., and Fujikawa (as well as in the liquid crystal display device of the "invention" of Applicants' claim 58) the positions of the Ti and Al film are the reverse.

In Fig. 8 Nakamuara discloses a multi-layer conductive structure configuration of the elements 16/53/54 having aluminum layer in the bottom, titanium in the middle and titanium nitride in the top. It would have been obvious to one of having ordinary skill in

the art the time the invention was made to modify the device suggested by Abe et al., Shimada et al, and Fujikawa to have the aluminum layer in the bottom and the titanium in the middle as suggested by Nakamura, order to have a liquid crystal display device with less film peeling and superior adhesion and better conformity to the layer below and above of the multi-layer structure.

3. Claim 59 is are rejected under 35 U.S.C. § 103(a) as being unpatentable over Abe et al. (6,661,476) in view of Shimada et al. (6,448,578), and Fujikawa (6,414,738), as applied to claim 54, above, and further in view of Marieb et al. (5,909,635).

Abe et al., Shimada et al., and Fujikawa suggest a liquid crystal display device having every limitation of claim 58 except the requirement that the multilevel conductive structure is a four-level structure formed by inserting a Ti film between the Al-based and TiN films of the three layer multilayer structure claimed in claim 58 (and disclosed by Shimada et al.).

Marieb et al. disclose interconnect structure where in Fig. 1A-1C (and in claims 19-22) the required four-layer multi-level structure (Ti layer 100; Al alloy layer 110; second Ti layer 120; and TiN layer 130) is disclosed.

It would have been obvious to one of having ordinary skill in the art the time the invention was made to include the required four-layer configuration as taught by Shimada et al. Marieb et al., order to have a liquid crystal display device with less film peeling and superior adhesion and better conformity to the layer below and above of the multi-layer structure.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to FAZLI ERDEM whose telephone number is (571)272-1914. The examiner can normally be reached on M-F 8:00 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sue Purvis can be reached on 571-272-1236. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

FE
March 12, 2009

/Sue A. Purvis/
Supervisory Patent Examiner, Art Unit 2826